GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Geomechanics , PG_00042254						
Field of study	Civil Engineering						
Date of commencement of studies	February 2023		Academic year of realisation of subject	2023/2024			
Education level	second-cycle studies		Subject group	Optional subject group Subject group related to scientific research in the field of study			
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	4.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Geotechnics, Geology and Marine Civil Engineering -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Marcin Cudny				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours	Self-study		SUM
	Number of study hours	45		2.0	53.0		100
Subject objectives	Presentation of advanced problems concerning the mechanical characteristics of soils. State-of-the-art of the current research topics in soil mechanics.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U15] has advanced skills in civil engineering within offered specialization/profile	Ability to use advanced computational systems with non-standard constitutive models.	[SU4] Assessment of ability to use methods and tools
[K7_W03] has knowledge of Continuum Mechanics, knows rules of static analysis, stability and dynamics of complex rod, shell and volume structures, both in linear and basic nonlinear regime	Knowledge of limitations of the use of continuum mechanics in geomechanical problems. Knowledge of various measures of strain and objective stress velocities definition.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_U14] is able to plan and to interpret the geotechnical investigatons, to analyse the foundation stability; can design direct and deep foundations in complex soil conditions for complcated statical and dynamical loads	Ability to organize a field or laboratory test programs to calibrate any soil constitutive model. Ability to perform numerical element tests.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
[K7_W12] has deep and theoreticaly firm knowledge about geotechnical investigation, the rules of geotechnical design and engineering geology; knows the complcated processes in soil, techniques of foundations, draining systems, soil strengthening, geosynthetics applications, underground constructions and earthworks	Knowledge of the differences in the behavior of natural soils with the history of consolidation (overconsolidation) and soils reconstituted in the laboratory. The ability to determine the influence of geological processes (diagenesis, creep) on the actual mechanical characteristics of soils.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_W15] has deep and adequate knowlege of civil engineering, within offered specialization and profile	Ability to select soil material models to describe advanced mechanical characteristics of soils, e.g. barotropy, pycnotropy, structural anisotropy and stress induced anisotropy. Knowledge of the influence of these characteristics on the results of numerical analyzes of various geotechnical structures.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge

Subject contents

1. Stress and strain in the soil medium - summary and extension of knowledge from basic courses.
2. Basic equations of geomechanics.
3. FEM in geomechanics.
4. Criteria for shear strength.
5. Soil constitutive models - introduction.
6. The theory of elasticity and its application in geomechanics.
7. Selected problems of elasticity and plasticity in soil description.
8. Soil anisotropy.
9. Non-standard constitutive models of soils.

Prerequisites and co-requisites

Basic knowledge of soil mechanics, structural mechanics and mechanics of continuous media. Fundamentals of tensor notation.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
written exam or oral presentation	50.0%	100.0%

Recommended reading	Basic literature	1. Sawicki A.: Mechanika kontinuum. Wprowadzenie. 2. Gryczmański M.: Wprowadzenie do opisu sprężysto-plastycznych modeli gruntów. 3. ABAQUS Theory Manual - Version 5.7, Hibbitt, Karlsson & Sorensen, Inc. 1997 (and newer versions). 4. Niemunis A.: Theoretische Bodenmechanik mit Mathematica - available at ENauczanie. 5. Kreja I.: Mechanika ośrodków ciągłych. 6. Kleiber M.: Metoda Elementów Skończonych w nieliniowej mechanice kontinuum.. 7. Zienkiewicz, O., Chan, A., Pastor, M., Schrefler, B. And Shiomi, T: Computational Geomechanics with Special Reference to Earthquake Engineering
	Supplementary literature	Journals: Granular Matter Numerical and Methods in Geomechanics Computers and Geotechnics Acata Geotechnica Open geomechanics
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Strain measures best suited to describe deformation in geomechanical problems. 2. Definitions of stress velocities of Cauchy, Jaumann-Zaremba, Hill and Truesdell. 3. S shaped curve of soil stiffness degradation. 4. Conditions to be met by the constitutive model describing the behavior of soils in an elastic region. 5. Basic elements of the elastic-plastic constitutive model of soils. 6. Anisotropy in soil stiffness description - types, material parameters. 7. Differences between Mohr-Coulomb, Lade-Duncan and Matsuoka Nakai shear strength criteria. 8. Differences between hyperelasticity and hypoelasticity. 9. The transition from the forces between the soil grains to the stress tensor (micro-macro). 10. Modelling strength anisotropy of soils.	
Work placement	Not applicable	